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Benefits of Environmental Auditing
Case Examples

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This report documents the benefits of environmental auditing as described by managers responsible for their organizations' environmental audit program. In some cases, the examples illustrate actual benefits derived from individual audits, while in other cases the benefits result from having conducted a number of audits over a period of time. It provides insights into how environmental auditors conduct their field work, what type of situations they are likely to uncover, and how facility-level environmental management can improve as a result of an audit.

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I. INTRODUCTION

BACKGROUND

In recent years, as more and more environmental audit programs have been established, a growing body of literature on the subject has emerged. However, little has been written describing the benefits of environmental auditing except studies to identify, in general terms, the benefits to industry, to the environment, and to regulatory agencies.

One of these studies[1] examined the benefits to industry of environmental auditing and concluded that the benefits to industry fall into two broad categories: increased environmental management effectiveness and a feeling of increased comfort or security. Auditing increases management effectiveness by identifying deficiencies and weaknesses that are corrected, providing assistance to facility management, increasing the level of environmental awareness, and accelerating the development of environmental management systems. Auditing provides increased comfort because it identifies and documents compliance status, improves overall environmental performance, improves the environmental risk management system, and provides protection from potential liabilities.

A second study[2] examined the benefits of environmental auditing to the environment and to the government. That study concluded that the benefits to the environment are that environmental audits identify pollution problems, provide a mechanism for problem control or elimination, and allow for anticipation and mitigation of environmental risks. It also identified the benefits of environmental auditing to regulatory agencies as better assurance of companies' compliance, more efficient use of government resources, improved cooperation with companies, more realistic definitions of compliance, and useful information about audit systems and compliance status.

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[1] Benefits to Industry of Environmental Auditing, Center for Environmental Assurance, Arthur D. Little, Inc., August 1983 (EPA Report No. 230-08-83-005)

[2] Environmental Auditing Programs: Benefits to the Environment and Government, Edwin H. Clark for Sterling Hobe Corporation, June 1983 (Report to U.S. Environmental Protection Agency's Regulatory Reform Staff)

Together, these earlier studies provided an assessment of the potential benefits of environmental auditing. They describe the aspects and kinds of outputs of environmental audit programs that contribute significantly to the achievement of corporate, environmental, and regulatory objectives. They did not, however, provide specific examples of actual benefits or beneficial outcomes of environmental auditing. The purpose of this report is to fill that gap by describing concrete examples of benefits actually resulting from individual audits and audit systems. This report does not, however, attempt to quantify the benefits from an individual audit or the benefits achieved over the long run from established audit programs. Nor has the environmental performance of organizations with auditing programs been compared with the environmental performance of organizations that have not established environmental auditing programs.

This report documents the benefits of environmental auditing as reported by managers responsible for their organization's environmental audit program. In some cases, the examples illustrate actual benefits derived from individual audits, while in other cases the benefits result from having conducted a number of audits over a period of time. The example benefits described in this report also provide insight into how environmental auditors conduct their field work, what type of situations they are likely to uncover, and how facility-level environmental management can improve as a result of an audit.

APPROACH

To carry out this study, representatives of 23 organizations were interviewed. Most of these organizations have established internal environmental audit programs; however, some of the organizations contacted have used third-party environmental auditors to either conduct their audits or to supplement their in-house auditing efforts. The organizations contacted comprise a diverse cross-section of industry, including the aerospace, automotive, chemicals, electric utilities, electronics, forest products, glass, measuring and scientific equipment, metals, medical products, office equipment and computers, petroleum, and pharmaceuticals segments of industry. In addition, several public-sector organizations that have implemented an environmental audit program were contacted. Virtually all of the individuals contacted indicated that they felt their environmental auditing program had resulted in significant benefits to their organization.

Most representatives of the companies contacted regarding their participation in this study were pleased to participate. Many audit managers indicated they were in favor of studies that would further a better understanding of environmental auditing. However, several of the audit managers contacted expressed some concern about the study. One common fear was that any series of case examples of inappropriate practices identified during environmental audits could mislead the reader into believing that noncompliance is widespread in many industrial settings while, in fact, most environmental audits confirm that plant activities are in compliance. In a few cases, companies refused to participate in the study because they feared that a

study of this nature would somehow be used to further efforts to establish a mandatory auditing requirement. Most organizations, however, believed that they had benefited significantly from their environmental auditing efforts and were happy to share examples of those benefits.

In examining the benefits of environmental auditing, the word "benefit" was interpreted broadly to include those aspects or outcomes of environmental auditing viewed as beneficial by the audit program managers contacted. This study did not attempt to quantify or verify the extent of the benefit(s) received. Rather, the goal was to develop descriptive examples of the range and variety of benefits accruing as a result of environmental auditing. Thus, for purposes of this study, benefits were assumed to be in the eye of the beneficiary.

Because this survey focused on individuals responsible for their organization's environmental audit program, most of the benefits were reported from the perspective of the organization that has undertaken the audit. These case studies are presented from that perspective and, where appropriate, the case examples are augmented with a brief discussion of potential benefits to other parties, based on an analysis of the outcomes or aspects of the audit situation.

Each example in this report is presented as a brief case study that describes the situation, identifies the benefit(s) as seen by the respondents, and describes the role that the environmental auditing program played in achieving the benefits.

CONTEXT FOR ENVIRONMENTAL AUDITING BENEFITS

The benefits of environmental auditing can be as wide and varied as the nature, organization, and objectives of existing audit programs. Benefits can range from the negative task of uncovering specific problems to the positive feeling of increased comfort; from situations that benefit many parties (e.g., company, environment, regulatory agencies, public) to those that benefit only one; from actions resulting from an individual audit to overall program results; and from those things influenced solely by the audit program to those things for which the audit program is one of several contributing factors. These issues are sufficiently complex to warrant a brief discussion before describing the case examples.

- ### Negative Nature of Auditing

Environmental auditing, indeed any type of auditing, is by its very nature somewhat negative. The basic purpose of most audits is to determine or confirm that systems are in place and functioning properly. To accomplish this objective, auditors in many of the more advanced audit programs examine in detail selected aspects of the management and control systems. While the audit effort involves considerable time spent determining compliance, the audit report often focuses on deficiencies. The presumption is

that line management has instituted systems and procedures to achieve compliance and, while the auditors spend a significant amount of their energies confirming this, their job is to find and report deficiencies where they exist rather than to evaluate day-to-day management.

This concept has major implications in understanding the benefits that result from environmental auditing. Because the audit is aimed at uncovering deficiencies where they exist, the best possible outcome of an individual audit is frequently a report stating "no exceptions noted." If a plant is 99% in compliance and the audit team finds one minor recordkeeping discrepancy, it is commonly the discrepancy that gets reported, not glowing comments about the plant's superior environmental performance.

As a result, many specific examples of "benefits" of environmental auditing provided for this study were stated in the context of finding problems. While these examples are important aspects of the benefits of auditing, they must be balanced with an understanding that in the vast majority of cases the problems identified are far outweighed by the good environmental practices observed. This point was emphasized time and again by the audit program managers contacted during this study.

- Parties Affected by Audits

The outcome of an environmental audit can potentially benefit a variety of parties, including the company, regulatory agencies, the public, and the environment. While different parties may be affected by an audit, it is not always clear which party benefits from a specific situation. Even within these groups, what is seen as a benefit by one individual is not necessarily seen as a benefit by another. For example, if an audit results in a decision to formalize certain plant-level procedures, this may be seen as a benefit to the corporate environmental manager, while the plant manager may think the current procedure works just fine and the new one only requires more time and paperwork.

Many of the case examples identified during this study were potentially beneficial to several parties. For example, any situation where an audit identifies a compliance discrepancy which is subsequently corrected may, in the context of the previous benefit studies mentioned above, be viewed as a benefit to industry (improved compliance performance), to the environment (problem identification and control or elimination), and to regulatory agencies (better assurance of company's compliance). As a result of this overlap, no effort was made to categorize the case examples by the benefiting party. Instead, this study attempts to note where one party in particular benefited.

- Link to the Environmental Management System

Environmental auditing is widely recognized as one component of an organization's overall environmental management system. There is an inherent difficulty in trying to describe the benefits of one component of a system, since audit objectives are also objectives of other environmental management activities.

This difficulty is magnified by the fact that a number of environmental audit programs do not routinely include problem solving or recommend solutions as part of their work scope. The responsibility for corrective action is most commonly assigned to line management and outside the scope of the audit program. In such situations, the auditor's task is done when the facts are reported. Here again, there is a tendency to describe the benefits of auditing in terms of the problems identified.

The case examples described in this report are ones for which an environmental audit, or series of audits, is either the principal source of, or a significant contributor toward, the beneficial aspect or outcome. In some cases the audit is the sole contributor--such as when an audit team finds an unknown problem which is immediately corrected. In other cases, the relationship is less direct, such as when an audit provides added incentive to accomplish a previously planned action (e.g., installation of a new piece of equipment or implementation of a new procedure). Between these two extremes, the audit can contribute to environmental benefits in a wide variety of ways.

II. EXAMPLE BENEFITS

This section of the report presents 41 examples of specific benefits, which are grouped under the following categories:

- Current compliance status
- Environmental awareness and training
- Risk assessment
- Operations and maintenance
- Monitoring, data collection, and recordkeeping
- Environmental management systems
- Information sharing and communications
- Other types of benefits

It is important to note that a particular situation might fit more than one category. To illustrate this, consider an audit that causes a plant operator to correct a compliance deficiency where the operator was unaware of the regulatory requirement. This situation could be an example of "identification of compliance status" or "awareness of environmental considerations." In situations such as this, the example has been included in the category that best reflects the manner in which the audit program manager described it.

CURRENT COMPLIANCE STATUS

Because the principal focus of most environmental auditing programs is to determine the compliance of operating facilities, virtually all audits result in a statement of compliance status. This statement is based upon a review of the current practices and procedures in place at the facility vis-a-vis federal, state, and local regulatory requirements. This section presents five case examples that illustrate the range of compliance related benefits that are derived from environmental audits. (Note: Subsequent sections also include compliance related audit findings that lead to benefits in other categories.)

Nonprocess Water Discharge

At a scientific instruments plant in Maryland, the environmental audit team found that nonprocess water was being discharged to the storm sewer instead of the sanitary discharge. This was discovered by reviewing the plant's sewer diagrams and physically observing the discharge points. As a result of the audit, efforts were initiated immediately to obtain approval from the local publicly owned treatment works (POTW) to include this waste stream in the plant's sanitary discharge. Within two months, all of the necessary changes were made to discharge the nonprocess water to the POTW. The audit benefited the company by identifying a noncompliance situation that was corrected and benefited the environment by causing the discharge to be rerouted to the POTW.

Unregistered Treatment, Storage, and Disposal Facility

A chemical manufacturing plant in the Northeast operates a waste disposal facility that handles the company's out-of-date material. Out-of-date material from several other plants owned by the company is also sent to this facility for disposal. Materials treated at the facility include mercury compounds and other hazardous wastes. An environmental audit conducted by the company reviewed the hazardous waste management activities of the plant and determined the plant was not registered as a treatment facility. The plant subsequently applied for registration as a hazardous waste treatment, storage, and disposal facility. Not only did the company benefit by correcting a noncompliance situation, but the regulators also benefited through the registration of a facility which otherwise might have continued to operate without the regulatory scrutiny resulting from compliance monitoring activities.

Correction of Deficiencies Prior to RCRA State Inspection

During a 1983 audit of a coatings and resins facility, the audit team, following the company's standard audit checklist, found a number of relatively minor discrepancies in the area of hazardous waste management. (For example, training program documentation was incomplete.) Two weeks later, the facility was visited by the state RCRA inspector, who spent twice as long as usual (about four to six hours) and, unlike previous visits, did not come up with any findings. During the two-week period after the internal audit, the plant had corrected all of the deficiencies identified by the audit team. Following the state inspection, the audit team leader received a

telephone call and then a letter from the plant manager thanking him for the efforts of the team. The audit benefited the company by helping bring about more favorable results in the state inspection and benefited the environment by bringing about faster correction of regulatory deficiencies.

Exceedances in POTW Requirements

The audit program manager of a large conglomerate reported that internal environmental audit teams have found several cases where facilities have exceeded local POTW sewer ordinance requirements. Because local authorities were not enforcing the local sewer ordinances, the facilities were exceeding several of the ordinances' parameters. The audit team identified these exceptions through an in-depth review of sampling and analysis records, pH strip charts, and reports to the local agencies. The exceedances were reported to company management. Reports to local authorities now identify all excursions beyond the ordinance parameters and, in some cases, the facility has been granted in writing a deviation from a specific parameter.

Unpermitted Air Source

At a chemical plant in Ohio, the audit team, following its formal audit protocol for air pollution control, found one air emission source that did not have a permit to operate. This source was found by reviewing the plant's emission inventory and visually observing the actual air sources both in the plant and on the roof. Within several weeks of receiving the final audit report, the plant submitted a permit application to the state agency. Several months later, the plant received a permit. This benefited the company by eliminating the potential legal and public relations liabilities that the unpermitted air source posed. It also benefited the environment and regulators by bringing this air source explicitly under regulatory and compliance monitoring scrutiny.

ENVIRONMENTAL AWARENESS AND TRAINING

Virtually all the audit program managers contacted mentioned improved awareness as one of the major benefits of their program. Frequently, improved awareness resulted from informing plant management of regulatory requirements of which they were previously unaware. In other cases, audits resulted in improvements in plant environmental programs which went beyond specific regulatory requirements. In yet other cases, audits heightened the awareness of staff temporarily assigned to the audit team.

While not a principal focus of most audit programs, opportunities for training occasionally occur which are viewed by the audit program as beneficial. Program managers reported that other benefits accrued both from formally training auditors in advance and from "on-the-job" audit training.

The following examples illustrate situations where a principal benefit of the environmental audit was improved environmental awareness or training.

NPDES Permit Deficiency	At a chemical plant in Pennsylvania, the audit team, following the company's formal water pollution control protocol, examined the facility's NPDES permit to ensure that all permit requirements were being complied with. The auditors first developed a schedule of all permit requirements applicable to the facility and then thoroughly reviewed the piping and sewer diagrams available at the plant. Next, they inspected each of the drains and outfalls during several tours with the plant environmental coordinator. As part of their review, the auditors found that the cooling tower blowdown and deionized water regenerant were being discharged through an outfall that was permitted for storm water only. Facility management were aware that this practice was occurring but did not realize that it was improper. Shortly following the audit, the facility contacted the state regulatory agency requesting that the permit be revised to include the two additional wastewater streams. Within several months, the state issued a revised permit. This situation benefited the company by identifying and correcting a compliance deficiency and raising the awareness of plant management. The regulators and environment also benefited from the submission of a revised permit application that more accurately describes the facility's discharges.
Deficiencies in Spill Prevention and Control Equipment	During an environmental audit of an oil pipeline in Texas, an auditor was reviewing the oil storage facilities at one of the pumping stations. As prescribed by the company's environmental audit protocol, the auditor physically inspected the oil storage locations to confirm compliance with spill prevention and control requirements. As a result of this inspection, the auditor found that several of the drainage valves in the earthen dikes were defective or broken. Additional inquiry revealed that the station operator was unaware of formal requirements for draining procedures. Within several days, the defective valves were replaced and all of the operators at

the facility were informed of the regulatory requirements. The benefit to the company of this action was, in addition to correction of a compliance discrepancy, improved awareness and understanding of environmental considerations on the part of the station operator. This situation benefited the environment and regulatory agencies in that a compliance deficiency and potential environmental hazard were corrected.

Unidentified Process Stream

At a medium-sized saw mill, an environmental audit team went through a careful examination of all water discharges from the facility. As a result of both a document review (looking at sewer diagrams, etc.) and physical inspection of the piping and equipment, the auditors found that the discharges from the large sawing equipment were properly managed. However, at one point during the audit, they found that the water used for cooling and guiding one of the smaller saws flowed into a pipe located in the basement of the building and was then discharged directly into the storm sewer. The audit team leader brought this to the attention of the mill manager, who was unaware that saw guide water was not being handled as a process stream. Within two weeks, the necessary changes were made to divert this stream into the facility's process discharge. Not only was a noncompliance situation corrected, but a "blind spot" was identified.

Improvements in Groundwater Monitoring Equipment

During an audit of a hazardous waste landfill in the East, the audit team physically examined each of the facility's groundwater monitoring wells. The audit team leader found that the plastic cap of one groundwater monitoring well had been sheared off. Further investigation, through both inquiry and observation of tire marks near the well, revealed that this situation resulted from a tractor operator who did not understand the purpose of the plastic tube. As a result of the audit, a new cap was placed on the monitoring well, a concrete containment area was built around the well, and a program was put in place to educate operators on the nature and importance of the groundwater monitoring equipment.

Training of a Pool of Auditors

An electronic components company initiated a corporate environmental audit program several years ago. Because the program involved selecting individual audit team members from a pool of plant-level environmental coordinators, formal

training in auditing methodology and techniques was conducted for nearly 50 potential auditors. In addition to preparing each participant to conduct an audit, the training has resulted in several other benefits, according to the audit program manager. For example, as a result of auditing other facilities, each auditor is better able to see and correct deficiencies at his or her own plant. In addition, several of the trained auditors have since been transferred to other departments within the corporation (e.g., purchasing, manufacturing, etc.). This has resulted in spreading a sensitivity for environmental concerns to other parts of the company.

"Boning Up" on Regulations

A senior environmental auditor at a large petroleum company indicated that one benefit of an environmental auditing program is that it forces auditors to "bone up" on regulatory requirements in advance of an audit. In particular, the auditor noted that in preparing for several recent audits, a careful review of state regulations revealed subtle requirements that the auditors were not aware of. These requirements were added to the audit protocol used by the team in conducting each audit. This provided a benefit to the company in two ways: It provided increased assurance that the plant was reviewed for conformance with all applicable regulatory requirements, and it increased the skills and knowledge of the corporate environmental staff members who were serving as auditors.

RISK ASSESSMENT

While most of the participants in this study described the principal focus of their audits as regulatory compliance, several described examples where environmental hazards were identified during the course of the audit. In some cases, these hazards represented situations where the auditor anticipated future regulatory requirements to apply, while in other cases, situations, in the auditor's professional opinion, posed a potential risk to the company and/or the environment, even though they were not directly related to a specific regulatory compliance requirement. Six case examples of risk assessment benefits of environmental audits are presented:

Relocation of a PCB Transformer

During an environmental audit of a medium-sized forest products facility, one of the team members was assigned to cover the plant's control program for PCBs. Following a formal checklist, the auditor reviewed documentation relating to PCB control and then physically inspected each of the transformers on-site. During this inspection, the auditor noticed that one large PCB transformer was located in an area of the plant where fork lift trucks and other vehicles frequently passed. While the transformer appeared to be controlled in accordance with regulatory requirements (labeling, inspection, spill containment, etc.), the auditor realized that the location of the transformer posed a potential hazard because of the possibility of a vehicle collision. The mill manager agreed with the auditor's observation. As a result, a program was initiated immediately to move the transformer to a more secure area. Within three months, the transformer was moved to a new location, secured inside a newly built shed, and enclosed in a diked area. The principal benefit of this action to the company was an increased feeling of comfort that a potential hazard was reduced. The environment also benefited from the resulting reduction of risks of a PCB spill.

Relocation of a Hazardous Waste Storage Area

A team of company auditors spent several days reviewing the air, water, and hazardous waste activities at a Texas paint and coatings plant. Following their standard protocol for hazardous waste management, the auditors developed an understanding of the plant's practices for collection and storage of wastes and then closely inspected the facility's hazardous waste storage area. During this inspection, they noted that the storage area location was such that a spill could possibly reach a storm water runoff ditch. While there was no regulatory requirement under the facility's RCRA Part A permit to put secondary containment around the storage area, the audit team felt that the situation posed a potential hazard to the company and the environment. They recommended that the facility relocate the hazardous waste storage area to a more secure area. Immediately following the conclusion of the audit, facility management initiated steps to move the waste storage area to a vacant building on the plant site which had a curbed concrete floor and a roof. The move, which involved not only

relocating the storage area but also revising the RCRA Part A permit, was completed within several months. The move provided facility and company management with assurance that they were exceeding current regulatory requirements and reducing potential hazards to the environment and the company.

Inadequate Management of Hazardous Material

During an environmental audit of an electronic chemicals facility, the auditors discovered substantial quantities of material held for rework at various locations throughout the facility. The material--in itself hazardous--was not considered waste by the facility and, therefore, was not being stored, managed, or inspected in accordance with RCRA requirements as were the facility's designated hazardous wastes. The auditors considered this situation to be a potential environmental and loss prevention risk to the corporation, and notified appropriate levels of management. Management's attention was immediately directed to the situation and the situation was corrected. The audit led to increased inspection management and storage procedures for the materials, thereby reducing the risks of an inadvertent spill or similar environmental accident.

Leachate Collection and Treatment Practices

The environmental audit program manager at a large forest products company reported that in several instances, audits have identified activities which are not regulated in one state but are regulated in another. As the result of an audit of a pulp mill in the South, the facility instituted a procedure to collect leachate from a solid waste landfill located on-site and pump it into the facility's wastewater treatment facility. This action was not required in the state in which the facility is located; however, because it is required in other states, the audit team leader recognized this situation as a potential risk to the company and recommended that the change be made. The revised practice provides greater environmental protection as a result of treating the leachate.

Discovery of Leaking Underground Storage Tanks

After revising their audit protocol to explicitly investigate underground storage tanks and the availability of data to provide assurance that the tanks are not leaking, a chemical company's environmental auditors identified an underground gasoline storage tank during a routine facility audit.

Because no data existed, the auditors included a comment that they were unable to confirm the integrity of the tank. This led to the plant's scheduling a leak test and subsequent determination that the tank was leaking. The tank was removed and replaced and a clean-up was conducted. Moreover, as news of the situation traveled across the corporation, several other plants scheduled leak testing on their own and at least one other plant discovered that it, too, had a leaking underground gas tank which it corrected. The audit program manager reports that their environmental audit program has provided benefits to the environment and, in addition, has given them a head start on the regulatory programs addressing leaking underground storage tanks.

Identification of an Inactive Disposal Area

During their plant tour, environmental auditors conducting an internal audit of a chemical plant located in an Appalachian state observed a small brick wall located in a portion of the property no longer used for plant operations. Their concern and curiosity heightened when, upon closer investigation, they noticed that the vegetation near the brick wall was discolored. The auditors reported their observation in the audit report with a recommendation that more information be developed. Through discussions with former employees, plant management learned that the area had contained an open, brick-lined pit that had been used to contain process waste. However, the operation had long since been shut down by the company and the waste tanks forgotten. In fact, the plant had done its own investigations both in preparation for the corporation's audit and in response to inquiries regarding past waste disposal practices without identifying the tank. The materials in the pit were analyzed and appropriate off-site disposal was arranged. The materials were then excavated and transferred to a disposal site. The company benefited from identifying and addressing a potential environmental liability. The environment benefited from transfer of the wastes to an appropriate disposal activity.

OPERATIONS AND MAINTENANCE

Many of the audit program managers contacted during the course of this study noted that in some circumstances, environmental audits have led to improved facility-level operating and maintenance practices. In some cases, the changes resulting from the audit involved installation of new engineered controls, while in other cases the changes were procedural in nature. For example:

Audit of a Facility that is Frequently Inspected by the State

An environmental audit of a chemical plant located in a Northeastern state found that the audit team was unable to confirm that several pieces of installed air pollution control equipment were working properly. While the plant had undergone several inspections conducted by the local air quality agency, which had been delegated compliance monitoring authority by the state agency, without notation of any problems, the auditors viewed these inspections as largely "cursory" in nature. As a result, they carefully reviewed the air pollution control programs in spite of the frequent inspections with favorable results. In a review of maintenance records, they determined that one piece of equipment had been in operation with a work order to repair it that had been pending for more than 12 months. As a result of the audit's findings, the plant developed operational procedures to better demonstrate and confirm that pollution control equipment was performing as intended. This included development of additional monitoring and recordkeeping procedures and installation of a formal, documented, preventive maintenance procedure.

Improper Operation of Control Equipment

At a lead battery plant, an environmental audit team leader assigned one team member the task of completing the section of the air pollution control protocol that involved a review of the air permits and related control equipment. After examining the permits and developing a schedule of all permit requirements, the auditor physically inspected the air pollution control equipment. He then interviewed facility personnel about operating and maintenance practices. The auditor learned that the facility's wet scrubbers were being operated dry during the winter months, in violation of the air pollution control permit. The facility had experienced problems with the lines freezing in the winter which resulted in high maintenance costs. The situation was included in the audit report to management. As a result of the audit,

the scrubbers were winterized so that they operate year-round in accordance with the permit. This benefited the corporation by correcting a noncompliance situation and benefited the environment by the proper operation of the air pollution control equipment.

Maintenance of Dikes Around Bulk Oil Storage Tanks

An environmental team comprised of company environmental staff and an environmental manager from another facility found several instances in a large, Southwestern chemical plant where the diking that had been installed around bulk oil and chemical storage tanks was being defeated by drain pipes and open valves. Present day corporate engineering standards prohibit the use of drain valves in dikes. However, the plant had a number of older storage tanks that had been diked with a provision for draining accumulated rain water. These situations were identified by the auditors following an audit protocol that specifically calls for examination of the integrity of dikes around bulk storage tanks. The situation was reported to company management, and local management instituted a number of procedures to insure that the integrity of the dikes was being continuously maintained. The new procedures included a program of regular inspections and installation of large indicators visible from the plant roads to clearly indicate whether the drains are open or shut.

Leaks in Containment

An environmental audit of a sulfuric acid plant found that the integrity of secondary containment at a tank farm was inadequate because the containment was built from alkaline waste material. This finding resulted from a rigorous examination of spill prevention control facilities and procedures following a formal audit protocol. After careful review of the plant's oil and hazardous materials spill prevention plan, the auditors visually inspected the storage locations. During their inspection, they noted holes in the secondary containment resulting from acid storage. In addition, the audit team found that the tank farm was located near a waterway. The findings were reported to management and a more acid-proof secondary containment was installed. Both the company and the environment should benefit by a reduction of risk.

MONITORING, DATA COLLECTION, AND RECORDKEEPING

Environmental audits frequently identify opportunities for improvements in monitoring and data collection activities at operating facilities. In some cases, this results from finding out-of-compliance situations, while in other cases, improvements result from recommending new practices not required by regulations. For example:

Inadequate Monitoring Equipment

During an audit of an industrial chemical plant located in the Midwest, one of the team members had primary responsibility for reviewing the plant's water pollution control activities. After a careful review of the NPDES permit requirements and the facility's documentation for discharge monitoring and analysis, the auditor concluded that facility personnel were monitoring and recording the effluent flow as required by the NPDES permit. Further investigation and observation revealed, however, that the normal volume of effluent substantially exceeded the capacity of the weir to measure the flow. This resulted in grossly inaccurate reporting of the volume of the discharge. This finding was included in the audit report to company management. As a result of the audit, a proper weir was installed. The situation had not been detected by regulatory inspectors. As a result of the audit, the equipment was corrected and more accurate information was reported on the plant's discharge monitoring reports.

Documentation of Water Discharges

During an environmental audit of a chemical solution mixing plant, the audit team reviewed all of the plant's water discharges in accordance with a formal audit checklist. Upon questioning the plant environmental coordinator, reviewing the sewer diagrams, and inspecting the outfalls, the auditors learned that the plant discharges its process effluent to a local publicly owned treatment works (POTW) and the "clean" waste water--such as noncontact cooling water--through a permitted outfall to a nearby river. Further investigation revealed that both discharges converge in a common pipe and, at the end of that pipe, a diversion valve is used to direct the waste stream to either the POTW or the river. Previously, the plant had discharged all of its water to the POTW; however, when the POTW became volumetrically limited several years ago, the plant obtained an NPDES permit and began discharging its noncontact cooling water to the river when contaminated wastewater was not being dis-

charged. While the plant appeared to be operating in full compliance with regulatory requirements, the auditors were concerned that the plant had no formal records documenting that they were in compliance. As a result of the audit, facility management immediately instituted a new operating procedure whereby all discharges were logged in a book which also recorded any changes in the diversion valve. Less than six months later, a regulatory inspection resulted in inquiries about past operating practices, and the facility was able to demonstrate that they were, in fact, operating in compliance. Thus, the audit not only benefited the company but also benefited the regulators by causing additional information to be available for review. The audit also resulted in benefits to the environment by providing greater assurance that the facility's effluent was being appropriately discharged. Since that time, the two sewers have been segregated so that there is no longer a need for the diversion valve.

Preparation of Discharge Monitoring Reports

At a small forest products plant in the South, the audit team found that the operator responsible for preparing the quarterly discharge monitoring reports was not physically measuring the effluent pH. This situation was uncovered as a result of reviewing past DMRs and talking with the operator. The operator was unaware that this was required, and informed the auditor that nobody had ever before told him that his current practice was incorrect. As a result of the audit, a procedure was implemented to ensure proper analysis and reporting of effluent data.

Undetected Discharge to a Sewer

During an environmental audit of a sulfuric acid plant, the audit team found that the plant's effluent monitoring station had been installed at a point in the sewer system where it was not providing representative information on the discharges. An acid waste stream going to the sewer was located downstream of the plant's effluent monitoring station. This was found by touring the plant several times and carefully reviewing the sewer diagrams provided by the plant engineering department. The situation was reported to management as part of the audit report and steps to correct the situation have been taken.

Identification of Exemplary Practices

During an environmental audit of a power plant in the South, one of the auditors noted that the maintenance and calibration procedures for the facilities' continuous emission monitoring equipment were leading to a higher level of reliability (about 96%) than that required by regulations. One of the auditors conducting this audit had previously audited a number of other power plants owned by the company, and recognized this situation as particularly noteworthy. As a result of the audit, those procedures were implemented in other sister plants.

Responsibility for Hazardous Wastes Reporting

At a chemical plant in California, an environmental audit team found that the facility's internal practices for managing hazardous wastes did not assure that required monthly reports to the state were accurate and timely. Through a review of the monthly reports and the facility's manifest file, the audit team noted that a number of reports were not submitted and several shipments of hazardous wastes were not recorded in those reports that were submitted. This was due in large measure to the fact that the responsibility for completing the monthly reports rested with three people. As a result of the audit, responsibility for completing the monthly report was clearly delegated to one individual.

ENVIRONMENTAL MANAGEMENT SYSTEMS

Environmental audits frequently result in, or contribute to, changes and improvements in corporate or facility environmental management systems. These changes can include organization and staffing changes as well as improvements in such things as reporting practices, policies and procedures, or even improvements in the audit program itself. For example:

Increased Formality of Plant-Level Procedures

The environmental audit program manager of a large diversified corporation noted that since its initiation several years ago, the environmental audit program has been the major influence in increasing the formality of plant-level procedures for managing environmental activities. A section of the company's formal audit protocol addresses the adequacy of such procedures at each facility audited. In many cases, these procedures are not required by regulations. As a result of the environmental audits, specific procedures have been developed which identify regulatory requirements, define individuals responsible for specific tasks, and describe the reporting and documentation required.

Adding Plant Environmental Staff as a Result of an Audit

During an April 1984 environmental audit of a sanitary landfill in Colorado, the auditors noted a permit condition about which the plant manager was unaware. The operating permit stated that the facility would comply with the engineering report prepared by an outside firm prior to submittal of the permit application. After reading this statement, the auditors carefully reviewed the engineering report. The report stated that the facility would employ a full-time individual to collect litter and also install a windscreen around the perimeter of the facility. However, current practice was to hire temporary help through Manpower to perform the task of litter collection. As a result of the audit, the facility hired a full-time "litter picker" (before the final audit report was issued) and has budgeted for a litter fence in 1985.

Plant Managers Audit Other Facilities

A company that includes on the audit team an environmental manager from a plant other than the facility being audited has found that a number of benefits result from the other manager's participation. Not only does the participation help in making the audit a "peer review" but also provides a vehicle for learning about other facilities' environmental programs and procedures. As a result of participating on an audit team, plant environmental managers have a chance to see differences in state requirements, local procedures, and managerial style. In one audit, the environmental manager who served as a team member was so impressed with the spill control procedures he was auditing that he went back to his own plant after the audit and instituted similar measures. The program manager reports that environmental staff from other plants are often the toughest critics. He believes that participation of other plant's environmental staff has hastened the development of more formal environmental control systems within his company.

Improved Productivity and Credibility

An environmental auditor at a large petroleum company reported that one of the most important benefits derived from the program is the improved effectiveness in reviewing environmental performance that results as follow-up audits are conducted. Not only does it become easier to conduct an effective audit the second time around, but also the facility management and staff often

have greater confidence in the auditor's technical ability and in the value of an internal review of the facility's compliance status. This benefits the company's environmental management system in that audit results are more quickly developed and accepted.

Acquisition Audit

As a result of an environmental audit of a recently acquired foreign subsidiary, the auditors of a U.S. based multinational company determined that the newly acquired plant included a former landfill located at the plant site. However, no one at headquarters was aware, at the time of acquisition, that the situation existed. To avoid this kind of future surprise, the company has implemented a corporate procedure that requires on-site environmental assessments of all new acquisitions prior to purchase. The objective of the on-site review is to ensure that the company knows what it is buying before it buys it.

Audit Program Improvements

The audit program manager at an electronics company reported that they have made numerous improvements in their audit program since it was initiated several years ago. After several audits, they attempted to shorten the length of time in the field, and learned that this detracted from the audit. They now provide for about 20 person days of field work for an average-sized plant. Also, the experience of audits continues to result in changes in their formal audit protocols. Finally, to ensure audit quality, the team leader--who formerly had responsibility for a major section of the audit (e.g., air pollution control)--now functions primarily as a leader, supervising the team, reviewing the work of the audit team members, monitoring progress, and helping out where needed.

INFORMATION SHARING AND COMMUNICATIONS

Many of the audit program managers contacted mentioned that audits frequently result in improved communication. The improved communication can be between company management and facility management, among different facilities, or between the company or facility and an outside party, such as a local regulatory agency. For example:

Audits Communicate Corporate Environmental Commitment

The audit program manager of a large chemicals company reports that his company's three and one-half year old environmental audit program has served to reinforce the company's environmental policy. The audit teams, comprised of high-level personnel, provided tangible evidence at the working levels of the corporation's commitment to comply with environmental regulations and to conduct all of its affairs in an environmentally responsible manner. The audit manager feels that the program was introduced at an especially appropriate time in that several employees were beginning to get the impression that the country's environmental priorities were being relaxed while company environmental management had consistently stated that this was not the case (and have received assurances from senior management). The cost containment procedures prompted by the recession created mixed signals, especially where environmental performance was concerned. The audit program clearly reinforced the company's long established commitment to environmental assurance.

Communicating Information to Senior Management

At a large diversified corporation which has had an environmental auditing program for more than five years, the results of individual audits are routinely reported to senior management, and summary reports are provided to a committee of the Board of Directors. The audit program manager indicated that significant benefits have resulted from this reporting arrangement. Board members have gained comfort and assurance that systems are in place and functioning to manage compliance and that deficiencies are identified and brought to the attention of appropriate managers within the corporation. Similarly, senior management with overall line responsibility has benefited by knowing that their operations are receiving an independent review, that people responsible for environmental performance are aware of their responsibilities and accountabilities, and that procedures have been established to ensure continued compliance.

Sharing Audit Results with Other Plants

The audit program manager of a large petroleum company reported that significant benefits had been gained from sharing audit reports with plant managers from other plants. Following each audit, the final audit report is sent to the president of the operating company. The operating

company president is encouraged to share the audit report with representatives of other facilities within the company. In one recent audit of a refinery, the audit team noted several discrepancies relating to the spill prevention control and countermeasures (SPCC) plan. Procedures for control and maintenance of valves in dikes were inadequately implemented, and several dikes which were originally secure had recently been partially opened to facilitate access by plant personnel. Several months following the audit, the audit program manager received feedback that, as a result of distributing the audit report, similar problems had been found and corrected at other refineries within the operating company.

Groundwater Monitoring Data

An audit of a solid waste landfill in Ohio recently resulted in improved communication with the state regulatory agency. During the five-day site visit, the two-person audit team thoroughly reviewed the facility's permits, correspondence with regulatory agencies, and internal documents. Before arriving on-site, the auditors conducted an in-depth review of applicable federal, state, and local regulatory requirements. During this review, they noted that each groundwater monitoring well that the director of the agency deems necessary will be sampled semi-annually. Because no such requirement was stated in the permits, the auditors recommended that the facility contact the Ohio EPA to determine whether they should be reporting groundwater monitoring data, at what frequency, for what parameters, etc. (Following an internal company policy, the facility was currently collecting groundwater data.) Several months after the final audit report was issued, OEPA responded by saying that they would appreciate receiving groundwater monitoring data, but that there was no formal regulatory requirement. The facility is now sending data to OEPA and reports that improved communication has resulted.

Informing Management of Good Practices

The audit program manager of a petroleum company reported that one benefit of an environmental audit program is the opportunity to visually observe the company's facilities compared with neighboring facilities. In a review of the company's pipeline operations in Oklahoma and Texas, the auditor had an opportunity to observe the tanks, pumps, and pipelines of three or four other companies. The auditor found that in most

cases his company's facilities had less oil on the ground, better maintained equipment, and better overall housekeeping. The auditor was able to provide positive feedback to company management regarding the environmental performance of company operators in the field.

OTHER TYPES OF BENEFITS

From time to time, environmental audits result in beneficial outcomes that do not easily fit into the categories described above. For example, while not generally a major objective or focus of most environmental audit programs, opportunities for cost savings or recycling are periodically uncovered during an audit. Several examples are:

Cost Savings from Waste Segregation

During an audit of a Maryland plant that polishes and grinds glass lenses, the audit team, following a standard audit procedure, found that the plant was disposing all of its glass sludge as hazardous waste because it contained residue from leaded glass. Further investigation revealed that less than 30% of the residue came from leaded glass waste streams and that the balance did not classify as hazardous waste. As a result of the audit, the plant segregated the residue into separate waste streams, batch tested and analyzed each waste stream to verify that lead existed in only those waste streams originating from the leaded glass grinding operations, and instituted a procedure to dispose of the nonhazardous waste in a sanitary landfill. This change saved the company substantial money each year.

Reclaiming Waste Oil

During a 1981 audit of an electric utility service center, the audit team took several tours to physically inspect the facility. On one of these tours, a team member noticed an oil-stained area down an embankment. Upon further inquiry of an operator, the auditor learned that it was the facility's practice to dispose of waste oil from the trucks down the embankment--which was not located near a stream or waterway. As a result of the audit, this practice was immediately terminated, the site was cleaned up, and the contaminated dirt was removed. In addition, a new procedure was implemented to collect waste oil and send it to a certified reclaimer. This situation further benefited the environment in that not only was the contaminated soil cleaned up, but also a scarce resource is now reclaimed rather than sent for disposal.

Emergency Response Preparedness

At a utility located in the Western United States, an audit team recently discovered a potential weakness in the facility's emergency response procedures. Following a formal audit checklist, one of the auditors reviewed the spill prevention control and countermeasures (SPCC) plan. Part of this review involved asking facility personnel to walk through the procedures outlined in the plan for a mock spill. This exercise revealed that some of the spill response materials and resources were not as readily available as the auditor thought they should be. In addition, it became apparent that, should a spill occur after dark, it would be particularly difficult to respond. As a result of the audit, facility personnel are rethinking how the current system should be modified to maximize emergency response preparedness. Following this analysis, which they expect to take less than one month, the SPCC and other emergency plans will be revised as appropriate, strengthening the facility level emergency response system.

III. CONCLUSIONS

The case examples presented in this study clearly illustrate that environmental auditing can produce a wide variety of benefits.

THE BOTTOM LINE: AUDITING WORKS

Environmental auditing can bring about a wide variety of outcomes that not only benefit the organization that has established the audit program, but that may also benefit the environment and/or the regulatory agencies responsible for overseeing environmental performance. The audit program managers who provided input to this study are convinced that environmental auditing works. Environmental audits provide assurance that an organization has appropriate systems in place and functioning to manage its environmental affairs. Audits also identify compliance problems and control system weaknesses. In addition, audit programs serve to reinforce management's commitment to achieving and maintaining compliance with environmental regulations. Thus, environmental auditing provides a vehicle for reviewing environmental performance, identifying shortcomings, and initiating improvements or corrective actions.

Despite the lack of quantitative data, most of the organizations that participated in this study are convinced their programs are worth the required effort and resources. Nearly all the organizations that participated in this study have established and continue their audit programs on their own initiative. The others have headquarters-level directives to establish an audit program and are proceeding to do so.

Although there is consensus about the usefulness of environmental auditing among practitioners, it is often difficult to isolate or clearly distinguish the benefits of environmental auditing from the benefits of other environmental programs. Many of the outcomes of an audit that benefit the environment are merely initiated by conducting the audit. The actual benefit is fully realized only after other elements of an organization's environmental management system, such as action planning or capital budgeting, are brought to bear on a particular audit finding. Thus, just as auditing is only one component of an organization's overall environmental management system, it is also only one of several factors contributing to a beneficial outcome.

Similarly, it can be difficult to identify the beneficiaries of environmental auditing. Certainly, an organization that establishes an audit program (and its own objectives for the program) is a principal beneficiary.

The extent to which an organization benefits from the audit program is directly related to the proficiency of its auditors and the congruence between its audit objectives and methods. However, there are likely to be other beneficiaries as well. The public benefits whenever adverse environmental situations are identified and corrected. The public also benefits when the effectiveness of emission controls is improved, whether by meeting an existing compliance requirement or achieving an incremental gain over and above regulatory requirements. Regulatory agencies also benefit from environmental auditing when, for example, situations with an environmental impact are brought to their attention or when errors or omissions in the information required by regulations or permits are corrected.

THE LEVEL OF BENEFITS VARIES...

With Sophistication of the Auditing Effort

The nature and intensity of the auditing effort also impact the benefits that result from environmental auditing. The audit programs included in this study feature a wide variety of audit approaches and methodologies. In general, the programs can be thought of as falling into one of three categories:

Assessment Orientation: Some of the programs included in this study are "assessment driven." That is, the review or fact-finding process is based largely on the auditor's experience and judgment. Here, benefits can result from the added expertise and fresh perspective of the audit team that are brought to bear on the facility's environmental status.

Verification Orientation: Other audit programs include a substantial amount of compliance verification. That is, the review process includes specific audit steps or procedures designed to determine or verify first hand the extent that compliance is consistently being achieved. Many benefits of these programs result from in-depth examination of records and equipment. In addition to bringing additional expertise and a fresh perspective to assess the facility's environmental status, selected facility records and equipment receive a rigorous review to identify inconsistencies or departures from the standard practices. Thus, these audits are more likely to identify situations involving an occasional compliance exception.

Systems Focus: Yet other audit programs included in this study place a significant emphasis on in-depth examination of a facility's systems and procedures for managing the full range of environmental hazards (not just those covered by various compliance requirements). This audit not only brings the added expertise and fresh perspective achieved in the first audit category and the rigorous examination to identify occasional departures and exceptions achieved in the second

category, but also a systems perspective that seeks to identify weaknesses and vulnerabilities in the facility's approach to environmental management. Such an audit seeks also to identify weaknesses that may not yet have led to an identified compliance problem or environmental or tort risk, but could lead to such a problem in the future.

There can be significant differences in the nature and extent of beneficial outcomes from these three types of audit approaches. Regardless of the type of approach, an audit program can be valuable to an organization and result in benefits to the environment and the regulators. However, as more and more of a facility's "more obvious shortcomings" are identified and corrected (whether as a result of an audit, other internal review or management oversight activity, a regulatory inspection, or enforcement action), assessment driven audits will identify fewer exceptions and, therefore, produce fewer benefits. As organizations find and fix problems, assessment-oriented audit programs will need to shift their emphasis to confirming that compliance is being achieved (and perhaps also to determining whether appropriate compliance management systems are in place and functioning). More rigorous and in-depth review approaches and techniques will be required to find the occasional or infrequent deficiencies that may be occurring.

With Auditor Skills and Organizational Commitment

Another key factor in realizing the benefits presented in this study is the internal motivation and commitment to the auditing concept of the organizations with effective auditing programs. In these programs, structured, well-developed techniques and approaches are augmented not only by the ingenuity and resourcefulness of the auditors but also by the knowledge that the program has organizational support. Environmental auditing is far too young and ill-defined a discipline to expect that a structured approach alone will produce the desired results. While questionnaires and audit protocols can provide general structure and guidance, an "internal engine" must move an environmental audit program toward the achievement of its objectives. To a very great extent, the beneficial outcomes of environmental auditing occur because of the competence and skills of the audit staff, the commitment made to the program, and the organizational climate in which the program operates.